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B1M MX M2
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(56) Documents cited
GB 2183171 A GB 1604165 A GB 0104183 A
US 4746335 A

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Online databases: WPI & CLAIMS

(54) Subsea degassing system

(57) A system and method for boosting the transportation pressure in a subsea multiphase fluid pipeline (18) has at least one booster station (10). The booster station has a riser assembly separator (12) which allows the gaseous phase to separate from the oil and water phases. The gas collected can be used to generate energy to drive a pump (32) to pump the remaining liquid phase through a continuing production pipe (34); alternatively the gas may be separated and passed along line (40).

FIG.1

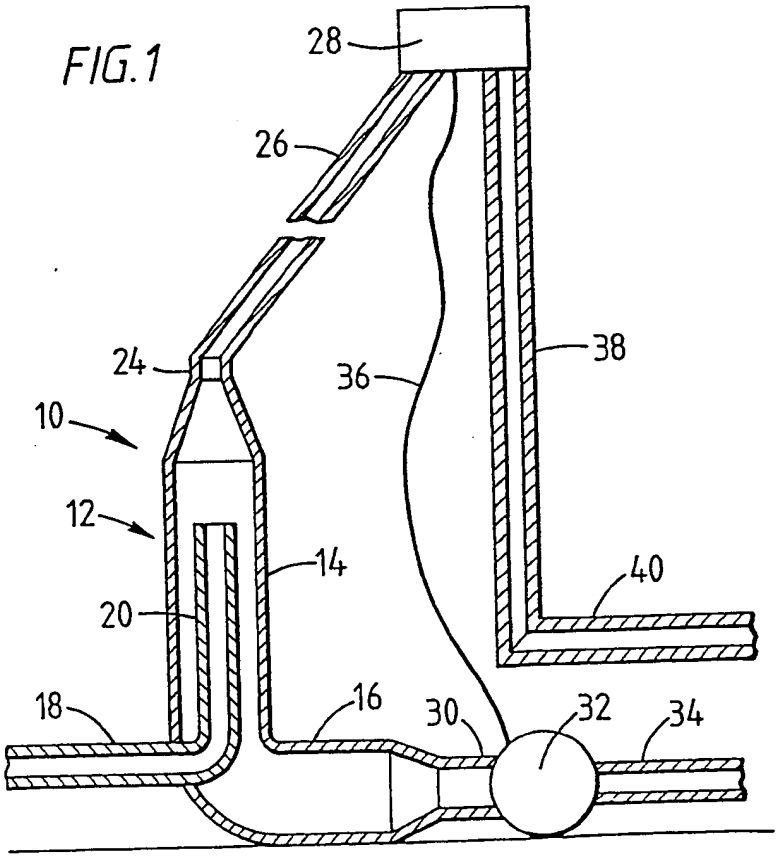

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FIG.1

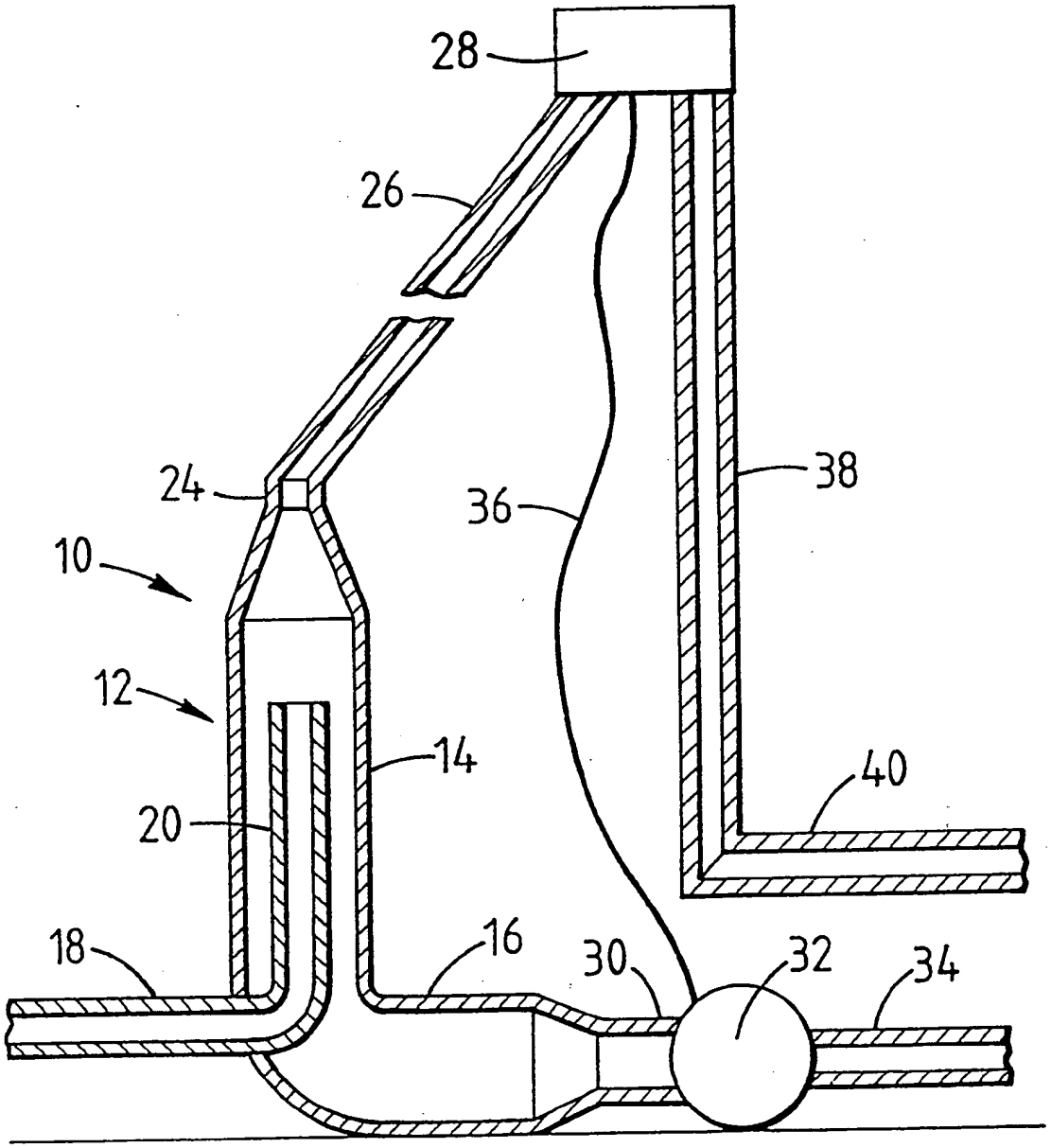


FIG. 2

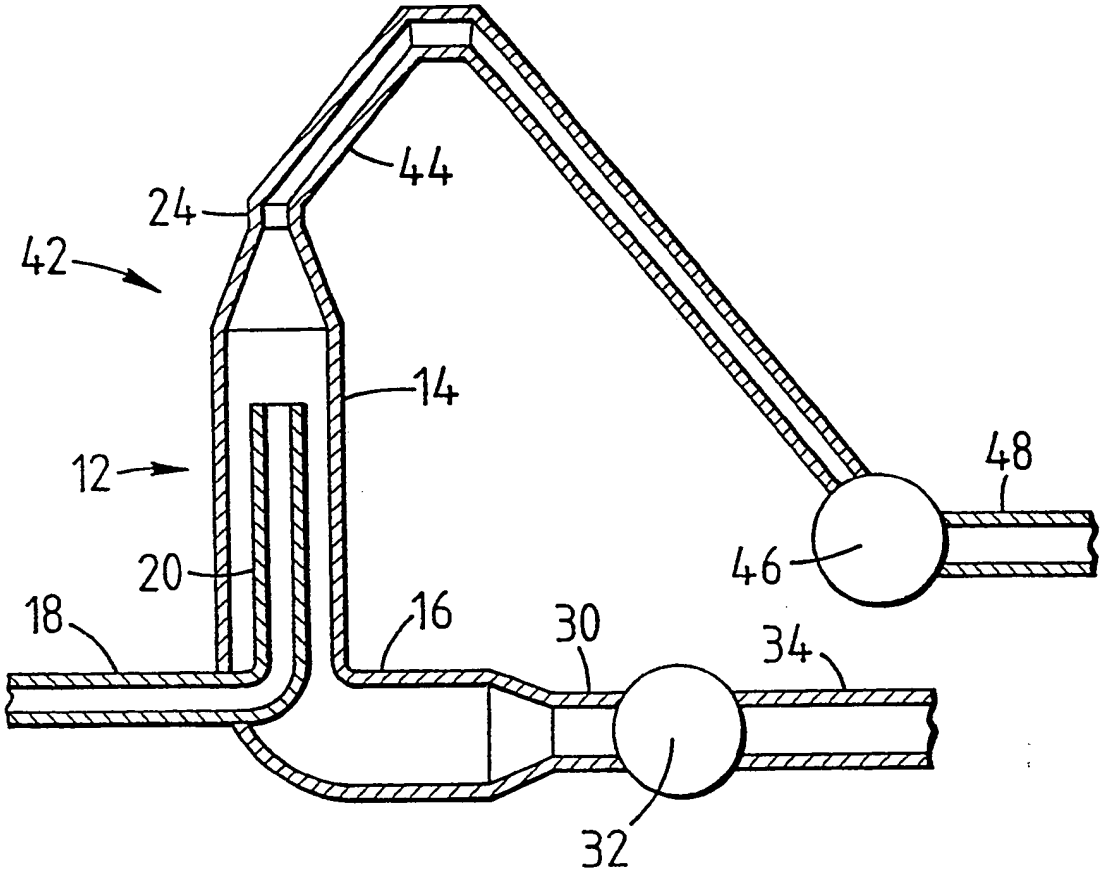
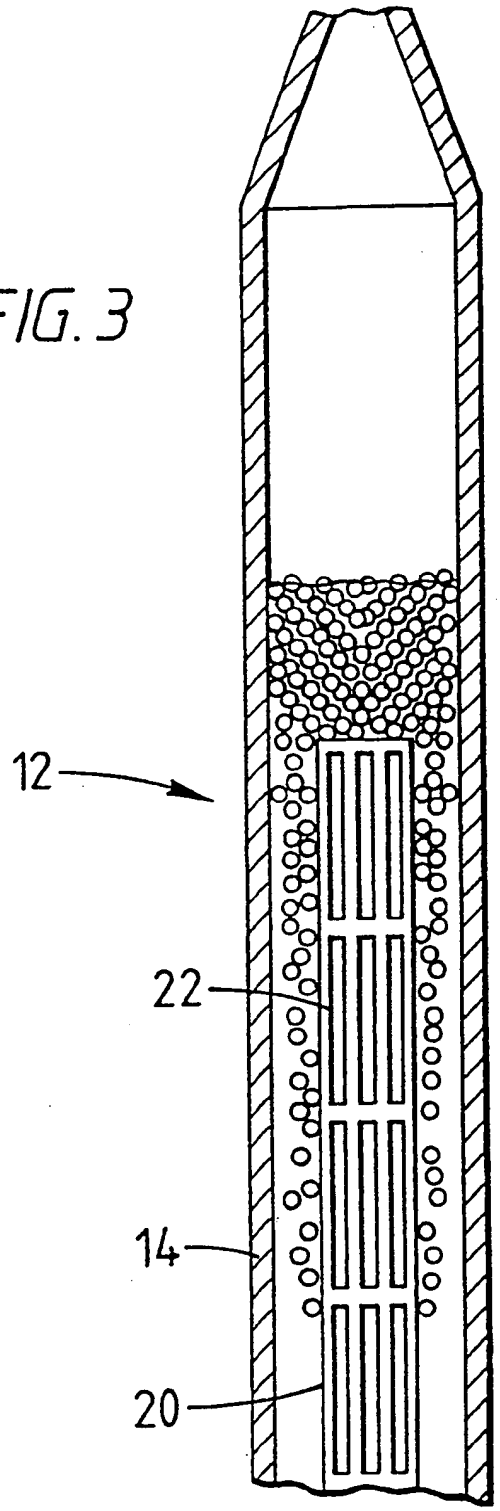


FIG. 3



SUBSEA SEPARATOR PUMP SYSTEM

The present invention relates to a method and apparatus for use in connection with transporting three-phase fluids for substantial distances under sea and in particular to a system for separating the phases in order to boost the transporting pressures.

It has long been established that there are substantial petroleum deposits located in the continental shelves throughout the world. Many techniques have been developed for subsea drilling to recover these subsea deposits. However, problems have arisen in the cost of these offshore operations and, in particular, in maintaining the various types of offshore platforms. These platforms are extremely expensive to own and operate and cannot be situated immediately above each and every well. Therefore, it is by far the preferred arrangement to have production facilities located on platforms so located as to service a number of wells and/or fields in an array about the platform. Even in this type of situation, there comes the

problem of transporting the three-phase fluids from the various well sites or collector sites to the processing platform.

There is a certain amount of energy that is available at the wellhead which can be used to propel the fluid through the pipes, but this pressure, obviously, will dissipate with time and distance. Also, in part because of subsea temperatures, there can be a buildup of condensates on the walls of the pipes thereby restricting fluid flow. Therefore, in order to be able to move three-phase fluids over substantial distances, it becomes necessary to provide a method and apparatus for boosting or regenerating transporting pressure.

Because these operations are taking place in a marine environment, many of the heretofore known methods and apparatus are not available such as, for example, merely in placing a three-phase pump in the pipeline. First of all, such a multiphase pump would be very expensive to construct and second, it must have a source of energy in order to operate.

The present invention concerns a method and apparatus for boosting pressure in subsea pipelines transporting three-phase fluid in order to transport the fluids over substantial distances. This is accomplished by having at least one station in the pipeline where separation of at least one phase of the

fluid occurs. The separated fluid can be used to generate power to drive booster pump means, which booster pump means can be of a significantly simpler design as it would not have to contend with a multiphase fluid.

The present invention will now be described by way of example with reference to the accompanying drawings wherein

Figure 1 is a schematic vertical section through a first embodiment of the subject invention;

Figure 2 is a schematic vertical section through a second embodiment of the present invention; and

Figure 3 is an enlarged detailed schematic vertical section through the separator portion of the subject invention.

The present invention is a system for pressure boosting to improve subsea transportation of three-phase (gas, oil and water) fluids. The invention provides at least one separation station in a subsea pipeline. This allows the gas and the oil/water fluid to be separated so that each can be efficiently pumped over some distance, for example, 15 to 50 km. to either another booster station, the shore or to a production platform.

The present invention is simple in principle and its operation substantially automatic.

Turning first to Figure 1, the booster station 10 of the present invention is shown in a first embodiment and has a riser assembly 12 which is generally L-shaped with a vertical portion 14 and a horizontal portion 16. A production pipe 18 enters the riser assembly 12 near the bottom corner thereof and has a vertical portion 20 which rises substantially vertically and coaxially within the vertical portion 14 of the riser assembly 12. This end portion 20 of the production pipe 18 is provided with a patterned array of preferably elongated vertical slots 22, about the periphery thereof (see Fig. 3). The upper end 24 of the riser assembly 12 in this embodiment is connected to a pipe 26 which extends to a surface facility 28.

This surface facility 28 can be any one of many known types from a free floating body or vessel to a fixed facility supported on legs or pods securing it in a fixed position to the ocean floor. The pipe 26 would be constructed to accommodate the effects of wave motion on the surface facility and, therefore, be provided with known flexible couplings etc., none of which have been shown. The surface facility can also be provided with means (not shown) to convert gas to energy and/or compressor means (also not shown).

The riser assembly 12 has an exit pipe 30 connected to a liquid pump 32 which is connected to the continuing production pipe 34. The surface facility 28 is connected to the pump 32 by an electrical cable 36.

It is also within the purview of the present invention to include a high pressure line 38 extending from the surface facility 28 to either the production line 34 or to a parallel high pressure gas line 40 as shown. While it is intended that the embodiment of the invention be either/or one of the above configurations, a valve could be placed between pipes 34 and 40 to allow selecting the desired operational condition should there be a change in operating parameters.

In operation, the three-phase fluid (not shown) is introduced to the riser assembly through the production pipe 18. As it passes upwardly through the vertical portion 20, the lighter gaseous phase separates from the heavier oil/water liquid phase. The former continues to rise to the surface through pipe 26 while the latter flows downwardly into horizontal portion 16 of the riser assembly 12. At the surface facility 28, the gas can be utilized in any of the known fashions to generate electrical power to drive the pump 32. If there is a sufficient amount of the gas, then it could be passed through compressor means (not shown) and passed on through pipe 38 to either the continuing production pipe 34 or to a separate gas pipe 40. This

would largely be determined by the conditions and requirements such as depth and distance for transmission etc.

The alternate embodiment 42, see Figure 2, differs from the primary embodiment in that there is no surface facility. In this embodiment the gas phase is allowed to separate in the riser assembly 12 and sent through pipe 44 to compressor 46 and to a separate gas pipe 48. The oil/water liquid phase is pumped by pump 32 in to continuing production pipe 34. This embodiment would rely on electrical power from a nearby facility, such as a production facility or nearby booster station as shown in Fig. 1, to drive the pump 32 and compressor 46.

In each embodiment of the present invention, as the three-phase gas fluid rises, the gas will separate at some height depending upon many factors including both pressure and fluid properties. For example, a three phase flow of 140 to 420 m^3/h in a 20 to 60 cm pipe would require 3 to 15 m of riser pipe in order to assure adequate separation of the gaseous phase from the liquid phase. The height of the riser pipe assembly 12 and the production pipe 20 therein should be sufficient to allow near complete separation of the produced gas from the produced liquid. As shown in Fig. 3, the vertical portion 20 of the production pipe is provided with a patterned array of vertical slots. Four aligned arrays of substantially equal size have been shown with more gas being separated towards the upper end. Staggered arrays

and slots of differing sizes and shapes could also be used. The gas will continue on up the riser, however the liquids will fill the riser assembly by virtue of its increased density of the water and oil. The pump 32 can be of a simpler design since it is pumping only the two-phases fluid of oil and water.

The present invention may be subject to many modifications and changes without departing from the spirit or essential characteristics thereof as defined by the appended claims.

CLAIMS:

1. A system for boosting pressure in a subsea three-phase fluid production pipeline comprising:

at least one separator station in said pipeline, the or each said separator station having a riser assembly including substantially vertical and horizontal portions; said production pipe entering said riser assembly and extending substantially concentrically at least partially up within the vertical portion thereof,

separator means adapted to allow the gaseous phase to separate from the liquid phase;

collecting means to collect the separated gas; and

a pump to pump the remaining two-phase fluid onward through the continuing production pipe.

2. A system according to claim 1 further comprising means for receiving said gas and utilizing said gas to generate power to drive said pump.

3. A system according to claim 1 or claim 2 further comprising means for compressing said gas and recombining it with said liquid phase after said pump.

4. A system according to claim 1 or claim 2 further comprising means for compressing said gas and forwarding it through a separate production pipe.

5. A method for boosting the pressure in a subsea three-phase fluid production pipeline comprising the steps of:

providing at least one separator station in said pipeline, the or each said separator station having a riser assembly including substantially vertical and horizontal portions;

said production pipe entering said riser assembly and extending substantially concentrically at least partially up within the vertical portion thereof;

passing the multiphase fluid through said pipe;

collecting gas separating from said three-phase fluid as it rises in said separator station; and

pumping the remaining two-phase fluid onward through the continuing production pipe.

6. A method according to claim 5 further comprising the step of utilizing said gas to generate power to drive said pump.

7. A method according to claim 5 or claim 6 further comprising the step of recombining said gas with said two-phase fluid after said fluid is pumped into said continuing production pipe.

8. A method according to claim 5 or claim 6 further comprising the step of compressing said gas and forwarding it through a separate production pipe.

9. A system for boosting the pressure in a subsea three-phase fluid production pipeline, substantially as described herein with reference to the accompanying drawings.

10. A method according to claim 5 and substantially as described herein with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

GB 9219589.0

Relevant Technical fields

(i) UK Cl (Edition L) B1M

(ii) Int Cl (Edition 5) B01D B67D E21B

Search Examiner

J H WARREN

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI AND CLAIMS

Date of Search

2 NOVEMBER 1992

Documents considered relevant following a search in respect of claims 1-10

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
Y	GB 2183171 A	(CHEVRON) page 1 lines 29-40 Figure 2	1, 5
Y	GB 0104183 A	(RASMUSSEN) input pipe c, d, riser a, horizontal portion k	1, 5
Y	US 4746335 A	(KARLSRUHE) column 1 lines 13-24, Figures 2, 4	1, 5
Y	GB 1604165 A	(SPIKEVALE) riser 10, 14 pump 15 input pipe 11	1, 5

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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